SUBDIFFRACTION OPTICAL RESOLUTION OF A GOLD NANOSPHERE LOCATED WITHIN THE NANOJET OF A MIE-RESONANT DIELECTIC MICROSPHERE

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ABSTRACT

We theoretically investigate light scattering from a bi-sphere system consisting of a gold nanosphere and a lossless dielectric microsphere illuminated at a resonant optical wavelength of the microsphere.

Using generalized multisphere Mie theory, we find that a gold nanosphere 100 times smaller than the dielectric microsphere can be detected with a subdiffraction resolution as fine as one-third wavelength in the background medium when the microsphere is illuminated at a Mie resonance. Otherwise, off-resonance, the spatial resolution reverts to that of the nonresonant nanojet, approximately one-half wavelength in the background medium.

An important potential biophotonics application is the detection of antibody-conjugated gold nanoparticles attached to the membranes of living cells in an aqueous environment.